

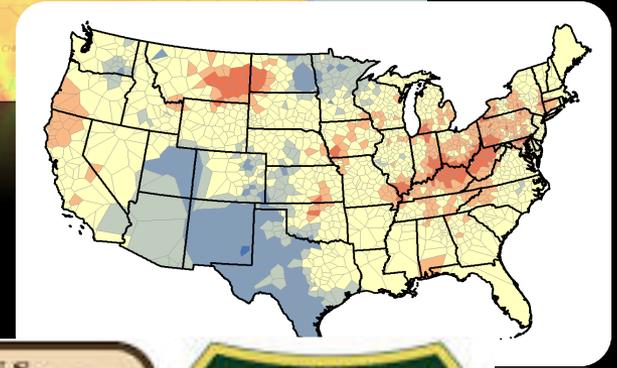
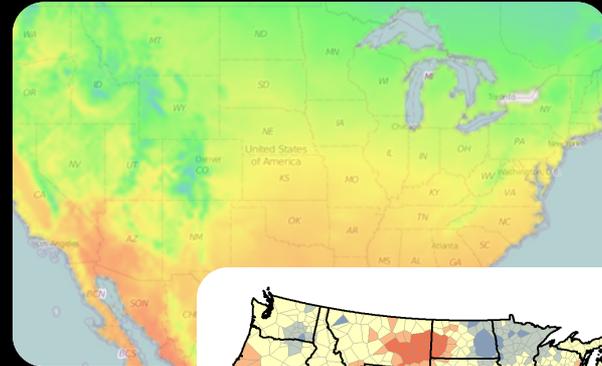
# Effects of extreme climate events on avian demographics

P. Heglund, A. Pidgeon, R. Akcakaya, T. Albright,  
A. Allstadt, B. Bateman, C. Flather, J. Gorzo,  
W. Thogmartin, S. Vavrus, A. Venegas, and  
Volker C. Radeloff

US Fish and Wildlife Service, USGS, US Forest Service  
University of Wisconsin-Madison,  
et al.,

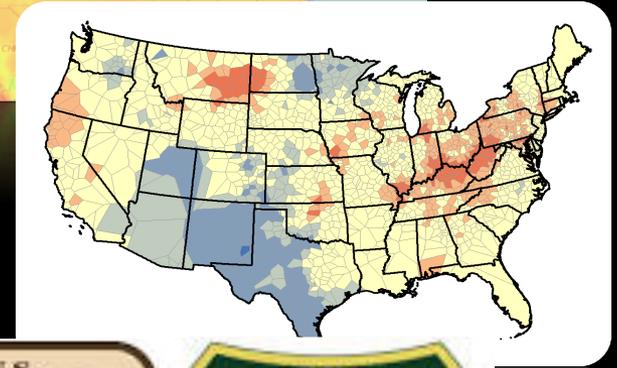
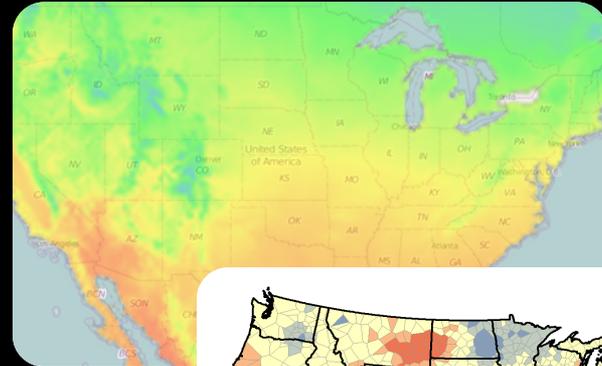
# Outline

- I. Extreme climate events
- II. Bird population response
- III. Conservation implications



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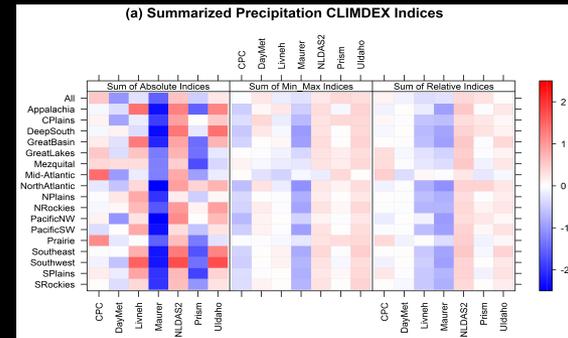


# Extreme climate events

Index	Weather Station Data		Climate Model Data BCCA, 19 CMIP5 GCMs, RCP45 and RCP 85	
	Daymet 1980 - 2014 1-km, daily	Maurer 1949 - 2010 12-km, daily	BCCA, 1950 - 2000 12-km, daily	BCCA, 2006 - 2100 12-km, daily
BIOCLIM, annually	Done	Done	Done	Done
CLIMDEX ETCCDI	Done	Done	Done	Done
Monthly and seasonal summaries	Done	Done	Done	Done
SPI	Done	Done	Done	Done
STI	Done	Done	Done	Done
SPEI	Not planned	Done	Done	Done
False springs	Not planned	Done	Done	Done

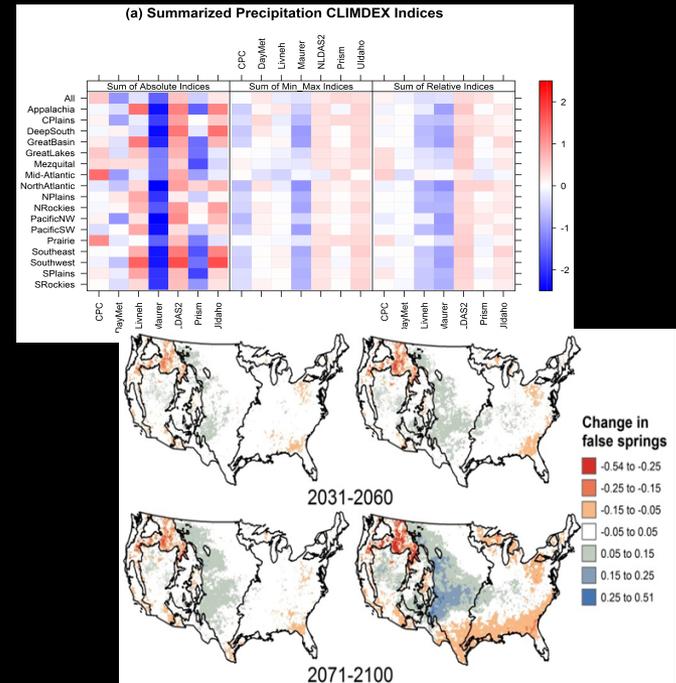
# Extreme climate events

- Behnke, et al. Evaluation of downscaled, gridded climate data ... *Ecological Applications*, in press.



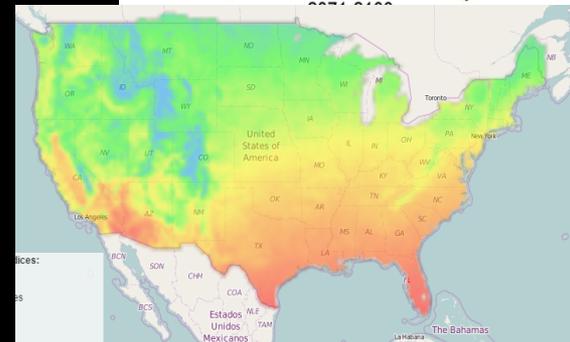
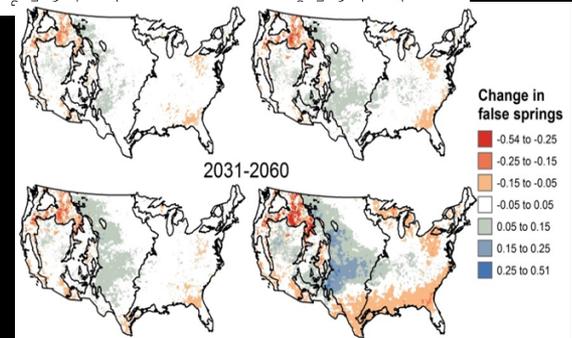
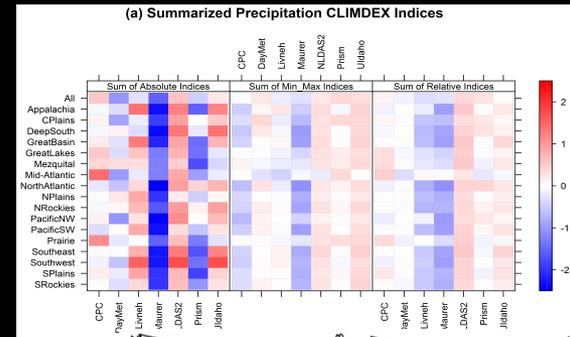
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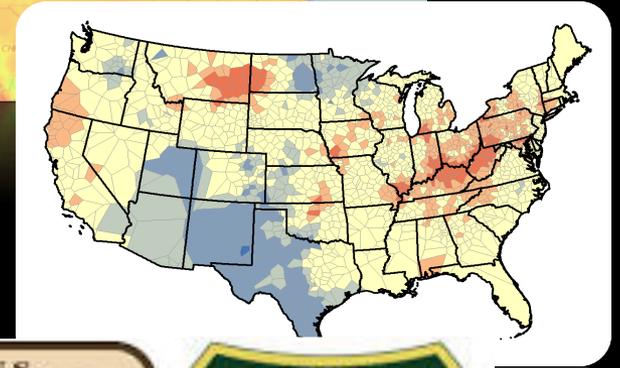
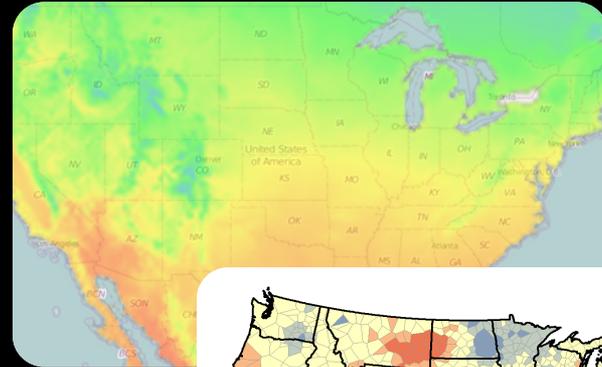
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- Allstadt, et al. *Ecology*, data paper, in review.



# Outline

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- III. Conservation implications



# Bird population responses

Extreme event

```
graph TD; A[Extreme event] --> B[Death]; A --> C[Move]; B --> D[Chicks]; B --> E[Adults]; C --> F[Emigrate]; C --> G[Concentrate];
```

Death

Move

Chicks

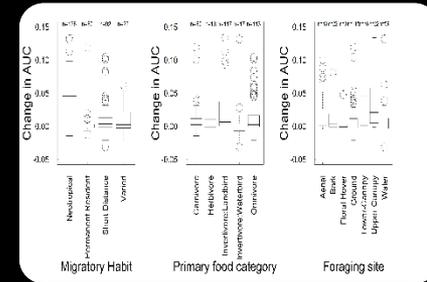
Adults

Emigrate

Concentrate

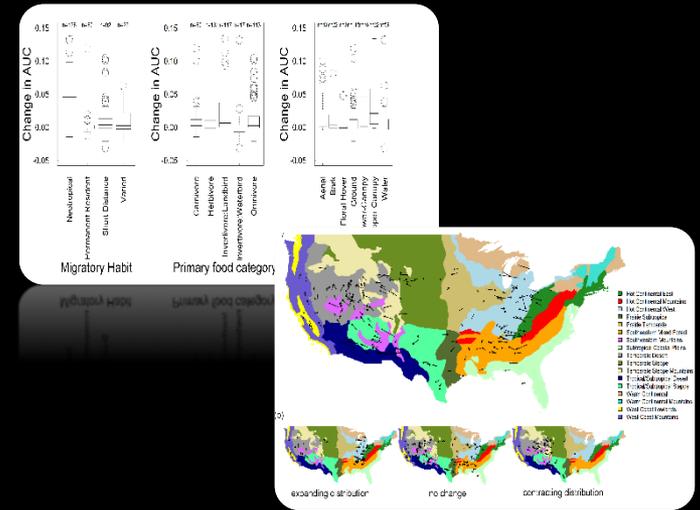
# Bird population responses

- Bateman, et al., Long- vs. short-term climate variability and birds. *EcoApps*, in press.



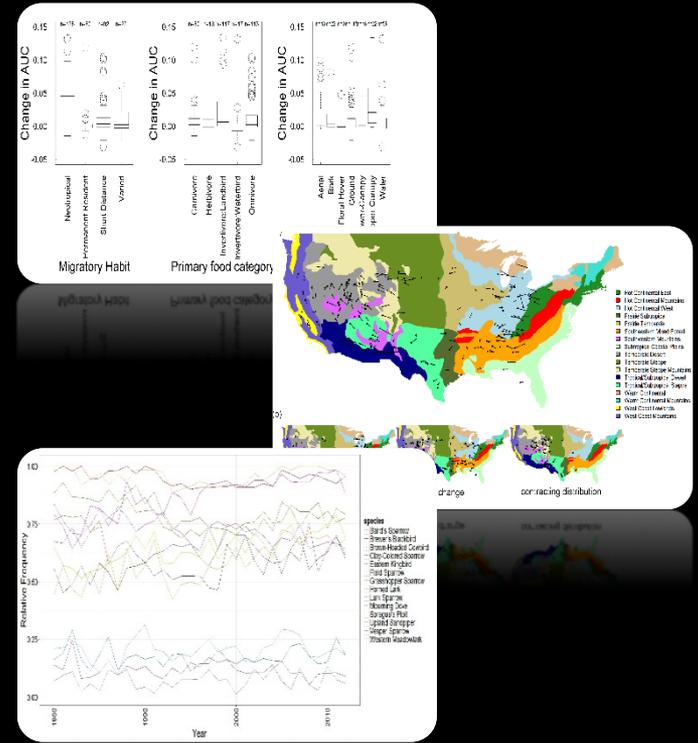
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- Bateman, et al., Long- vs. short-term climate variability and birds. *EcoApps*, in press.
- Bateman, et al., 2016. Past climate change versus bird distributions. *GCB*, 22: 1130-44.



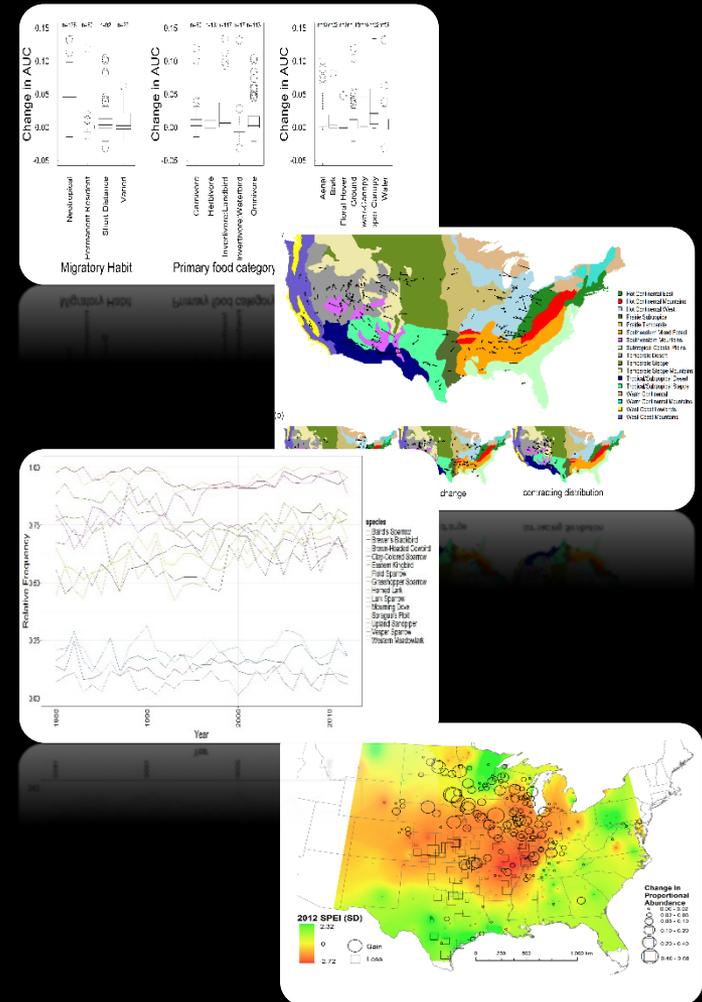
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- Bateman, et al. 2015. Range edges and irruptive species during extreme weather. *Lands. Ecol.*, 30: 1095-1110.



# Bird population responses

Extreme event

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graph TD; A[Extreme event] --> B[Death]; A --> C[Move]; B --> D[Chicks]; B --> E[Adults]; C --> F[Emigrate]; C --> G[Concentrate];
```

Death

Move

Chicks

Adults

Emigrate

Concentrate

# Bird population responses

- Bayesian Hierarchical Modeling with INLA

$$\log(\lambda_{i,t}) = R_{i,t} + \omega_{i,t} + I_{i,t} \eta + \delta_{i,t} + (1 - \lambda_{i,t-1} + N(0, \sigma_{i,t}^2)) \\ + V + \rho \sum_{i \neq j} w_{i,j} (v_{i,t} - V)$$

- Modeling a 20-year climate extreme versus the median year

# Bird population responses

Species	Local SPEI	Range-wide SPEI	Dec-May La Niña	Dec-May El Niño
Northern Cardinal	1.1	1.1	-0.2	0.2
Ruffed Grouse	-0.5	-6.8	5.2	-2.9
Rose-Breasted Grosbeak	1.5	1.2	-1.3	0.9
Indigo Bunting	-0.1	0.3	0	0
Grasshopper Sparrow	-4.3	5.3	0.6	-0.6
Lark Sparrow	3.3	6.2	2.5	-2.6
Dickcissel	-15.9	23.6	5.7	-4.1

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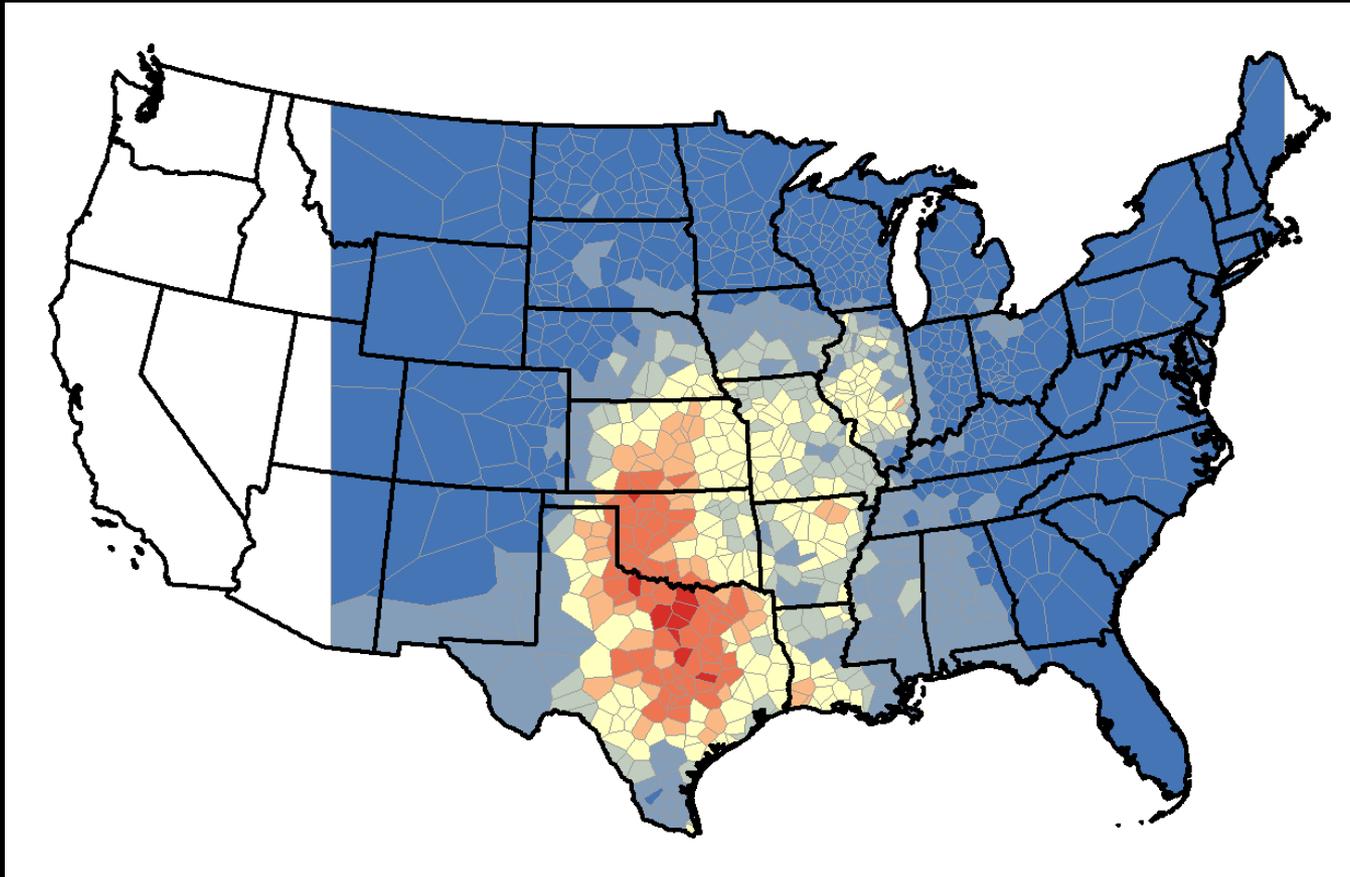
# Bird population responses

- Bayesian Hierarchical Modeling with INLA

$$\log(\lambda_{i,t}) = R_i + \omega_{i,t} + I_{i,t} \eta + \delta_{i,t} + (1 - \lambda_{i,t-1} + N(0, \sigma_i^2)) \\ + V + \rho \sum_{i \neq j} w_{i,j} (v_i - V)$$

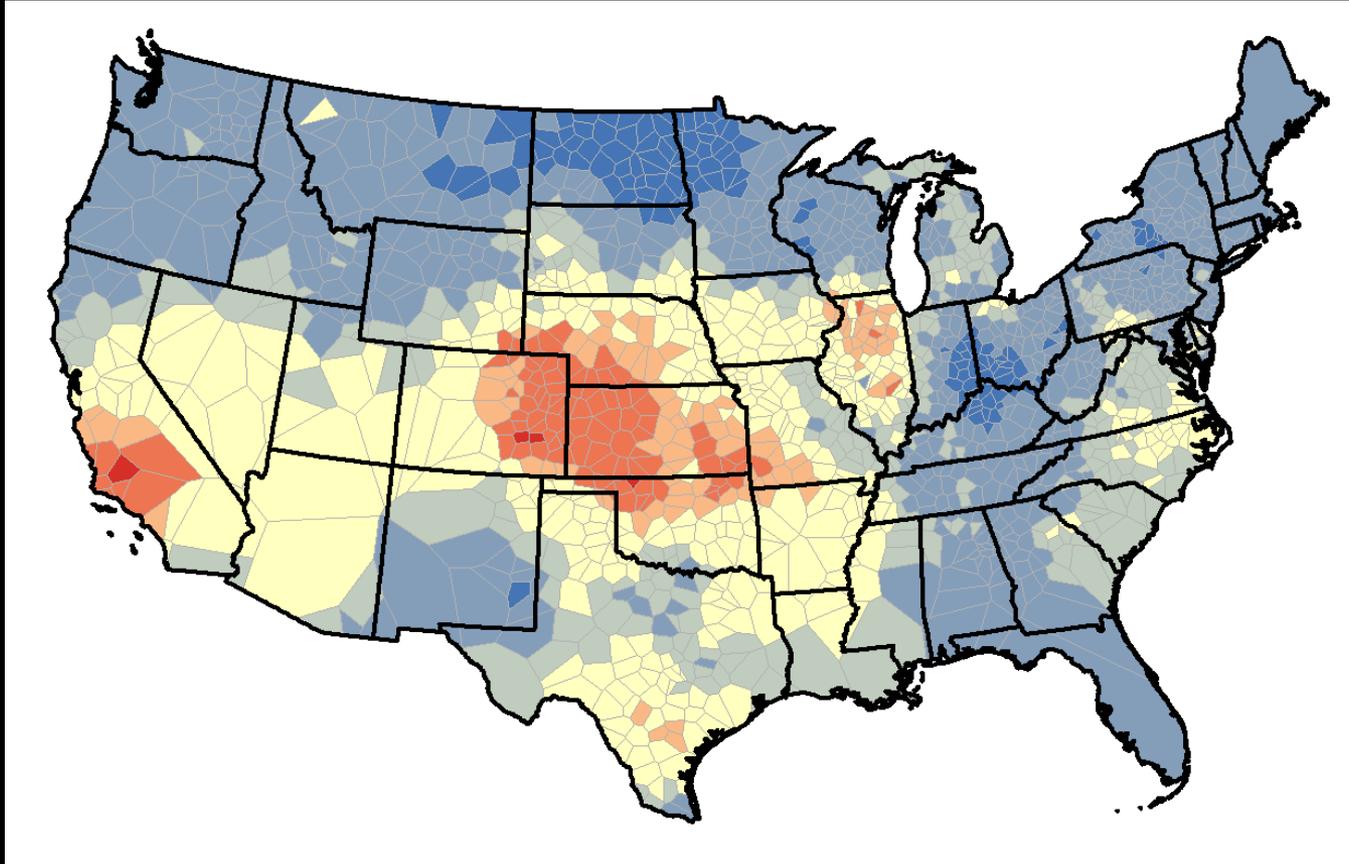
- Modeling a 20-year climate extreme versus the median year

# Bird population responses



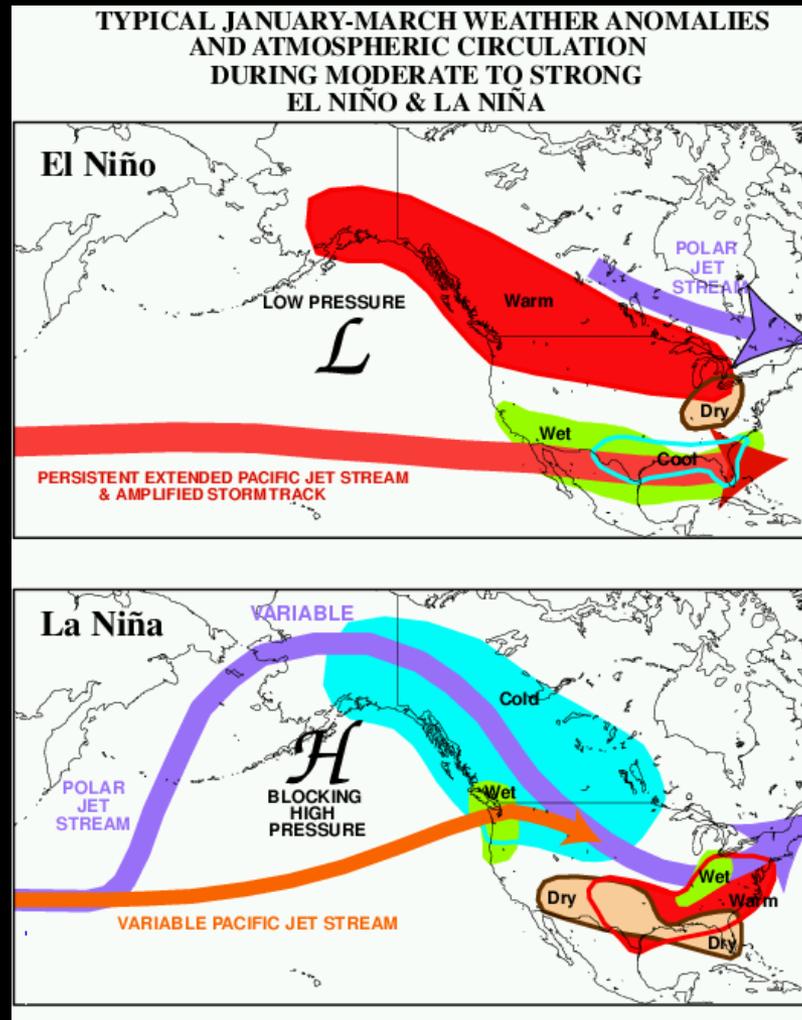
Dickcissel Rangewide SPEI

# Bird population responses

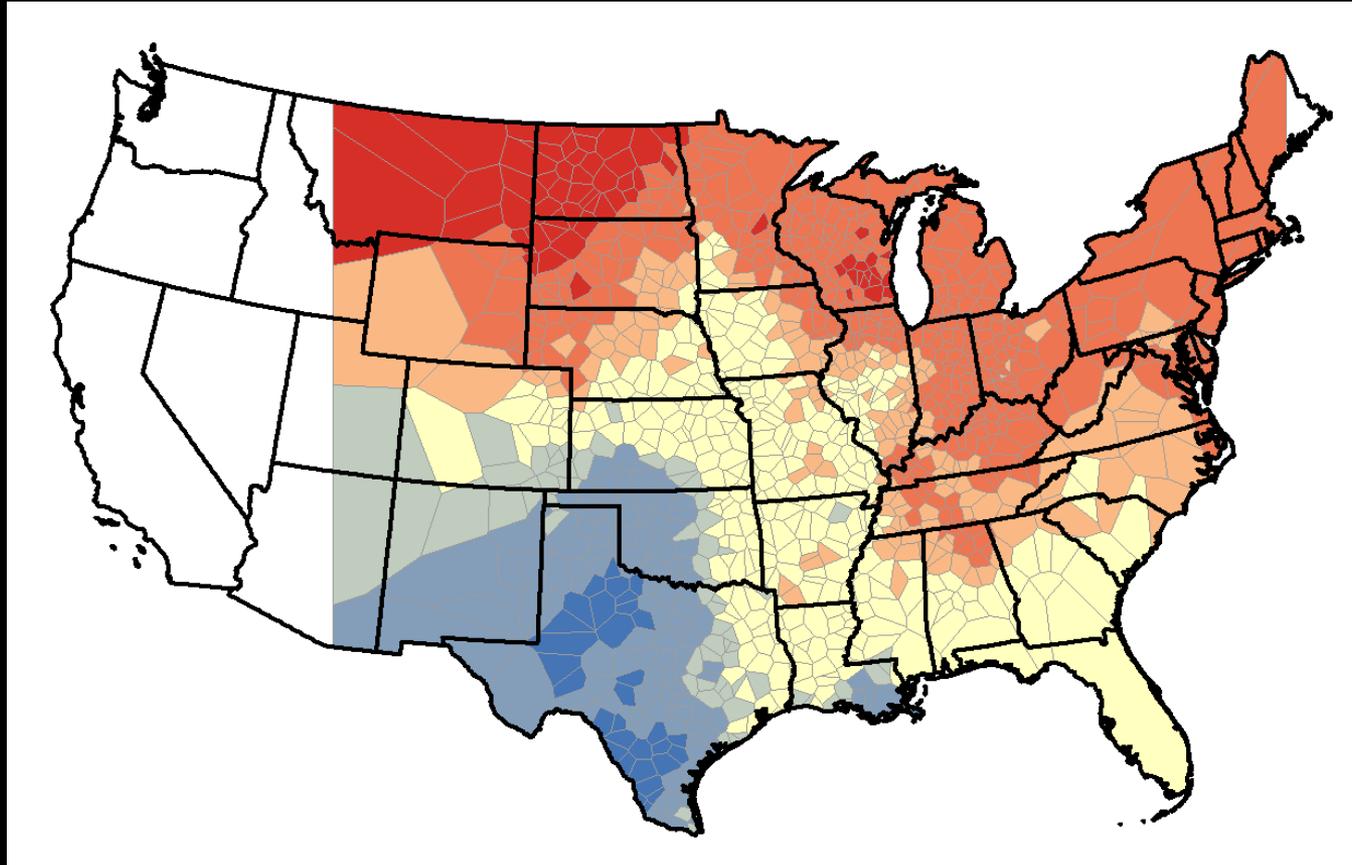


Grasshopper Sparrow RW-SPEI

# Bird population responses

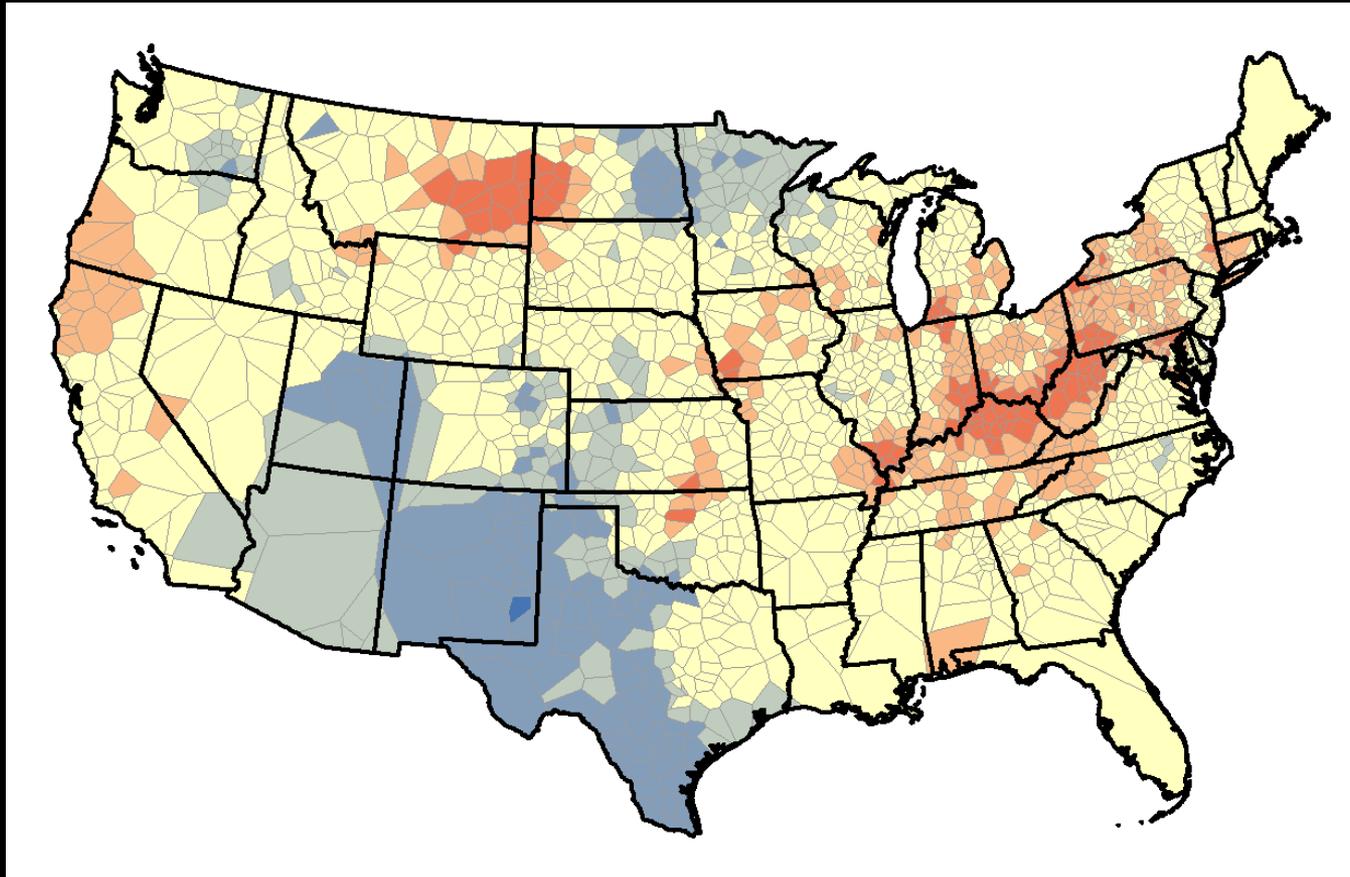


# Bird population responses



Dickcissel ENSO

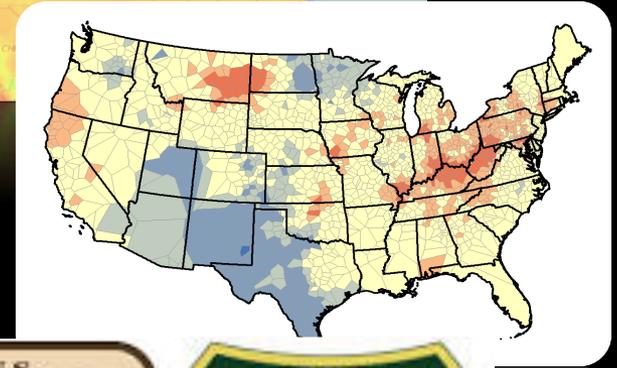
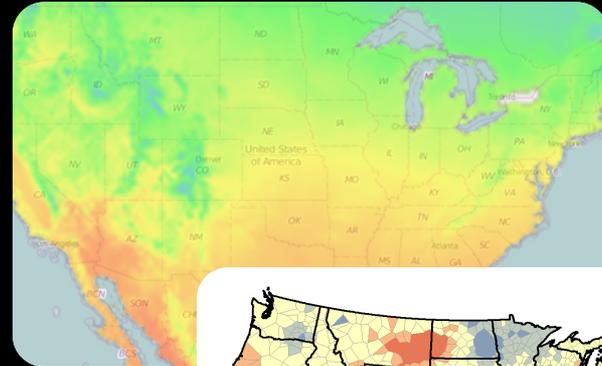
# Bird population responses



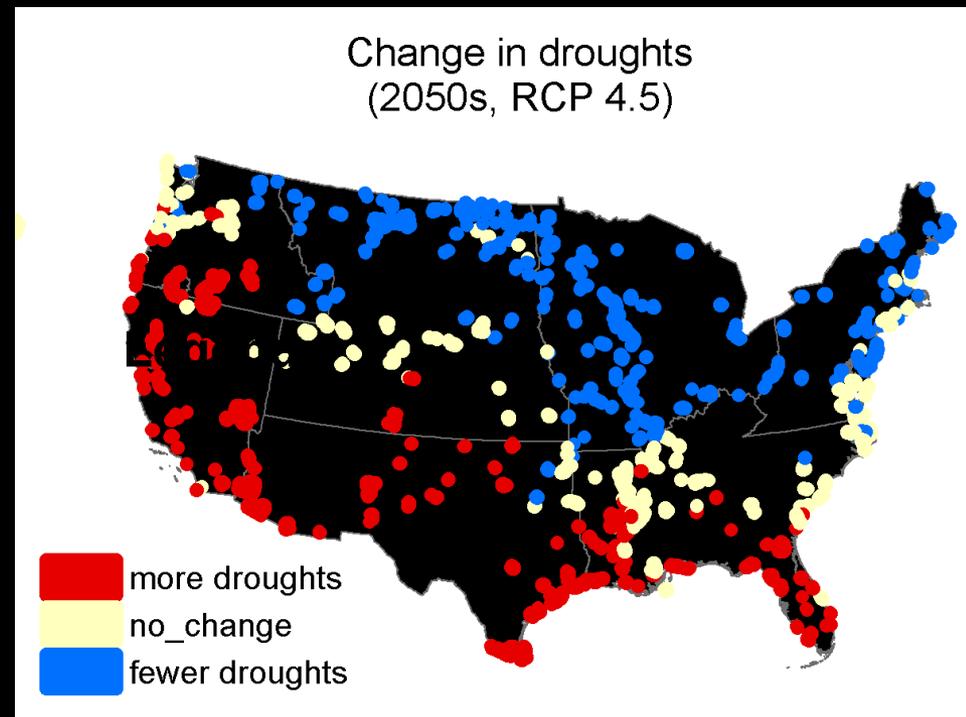
Grasshopper Sparrow ENSO

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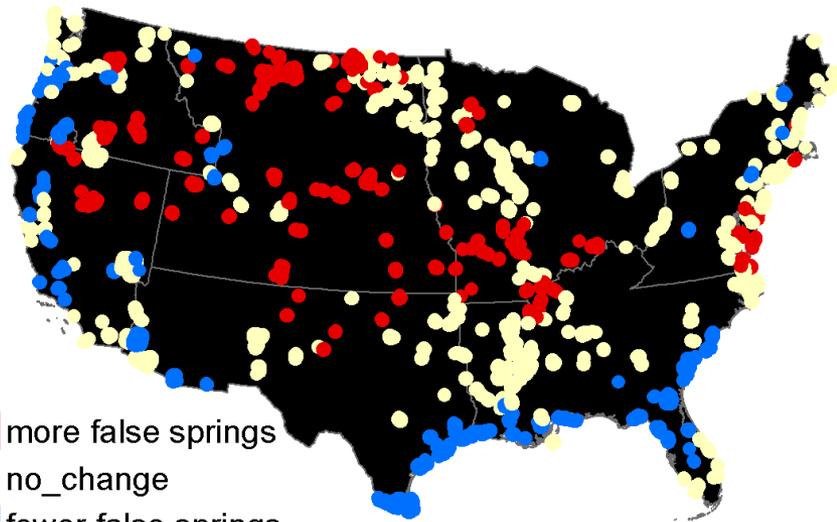
# Conservation implications



Martinuzzi et al., *in press*,  
Biological Conservation

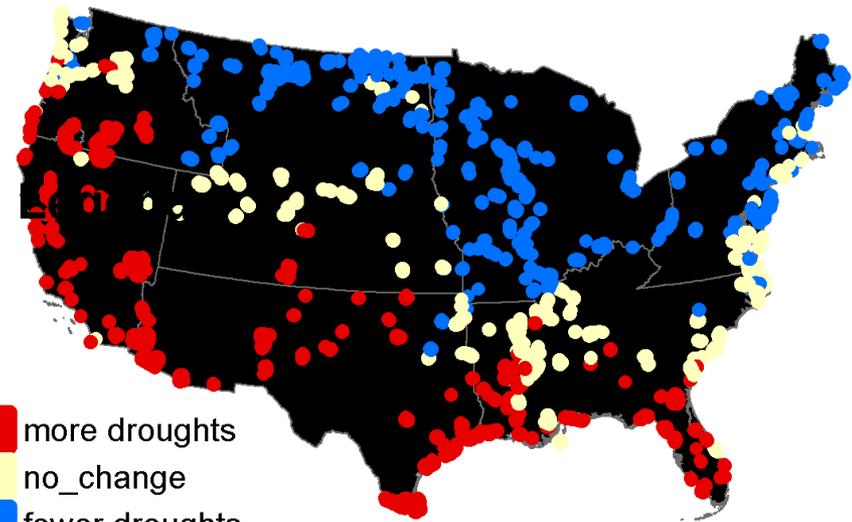
# Conservation implications

Change in false springs  
(2050s, RCP 4.5)



- more false springs
- no\_change
- fewer false springs

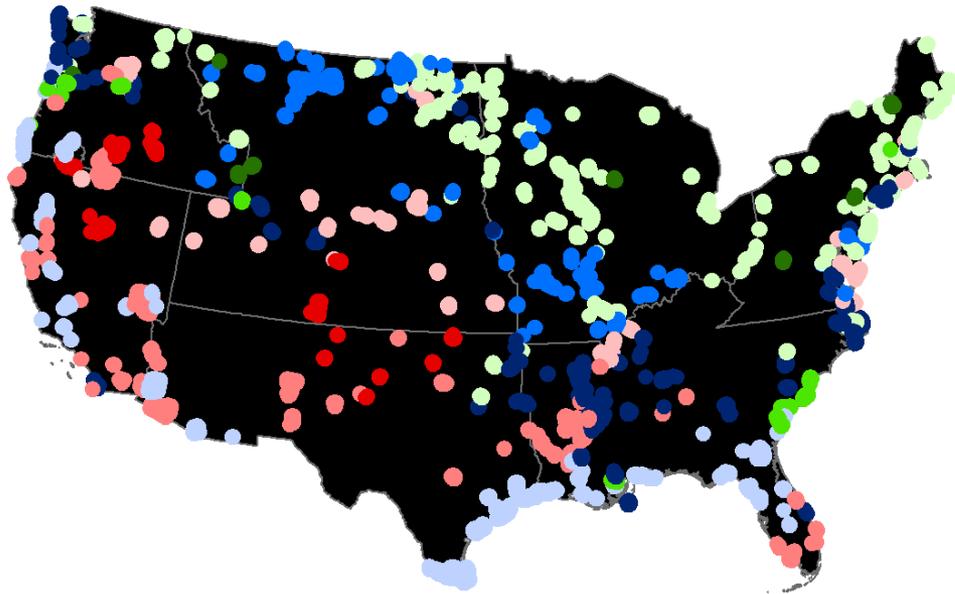
Change in droughts  
(2050s, RCP 4.5)



- more droughts
- no\_change
- fewer droughts

# Conservation implications

All variables combined (2050s, RCP 4.5)

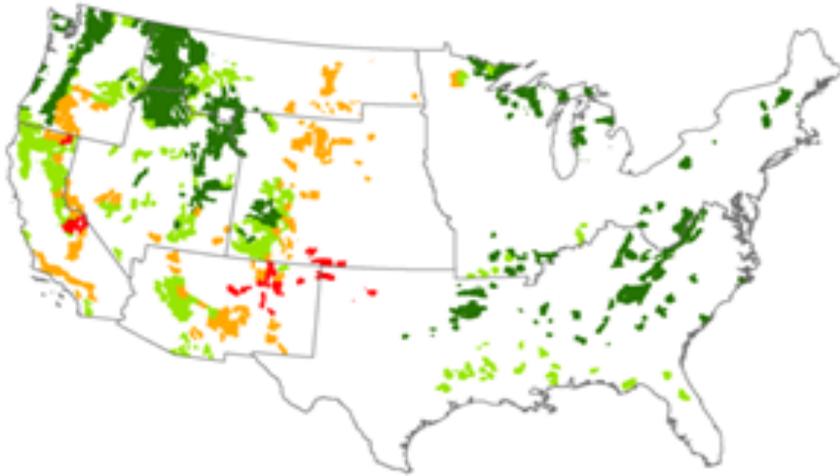


- more extreme warms, more droughts, more false springs
- more extreme warms, more droughts
- more extreme warms, more false springs
- more extreme warms, more droughts, fewer false springs
- more extreme warms, more false springs, fewer droughts
- more extreme warms
- more extreme warms, fewer droughts
- more extreme warms, fewer false springs
- more extreme warms, fewer droughts, fewer false springs

# Conservation implications

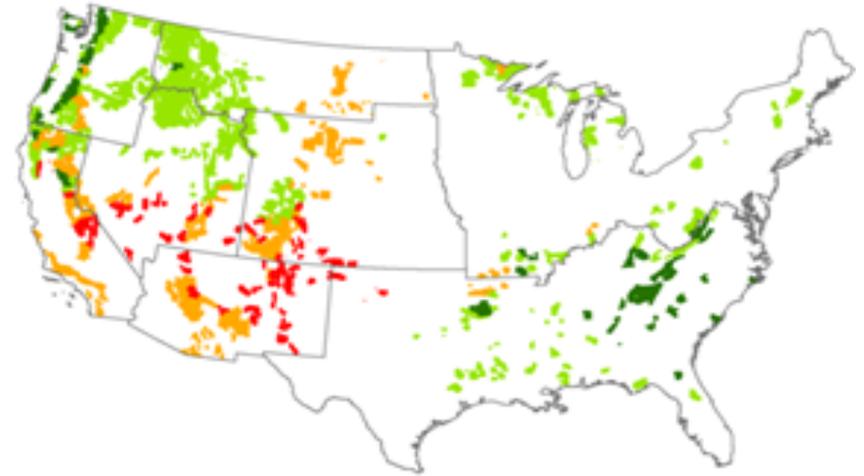
Mid-Century RCP4.5

Number of variables projected to increase  
■ zero ■ one ■ two ■ three



Mid-Century RCP8.5

Number of variables projected to increase  
■ zero ■ one ■ two ■ three

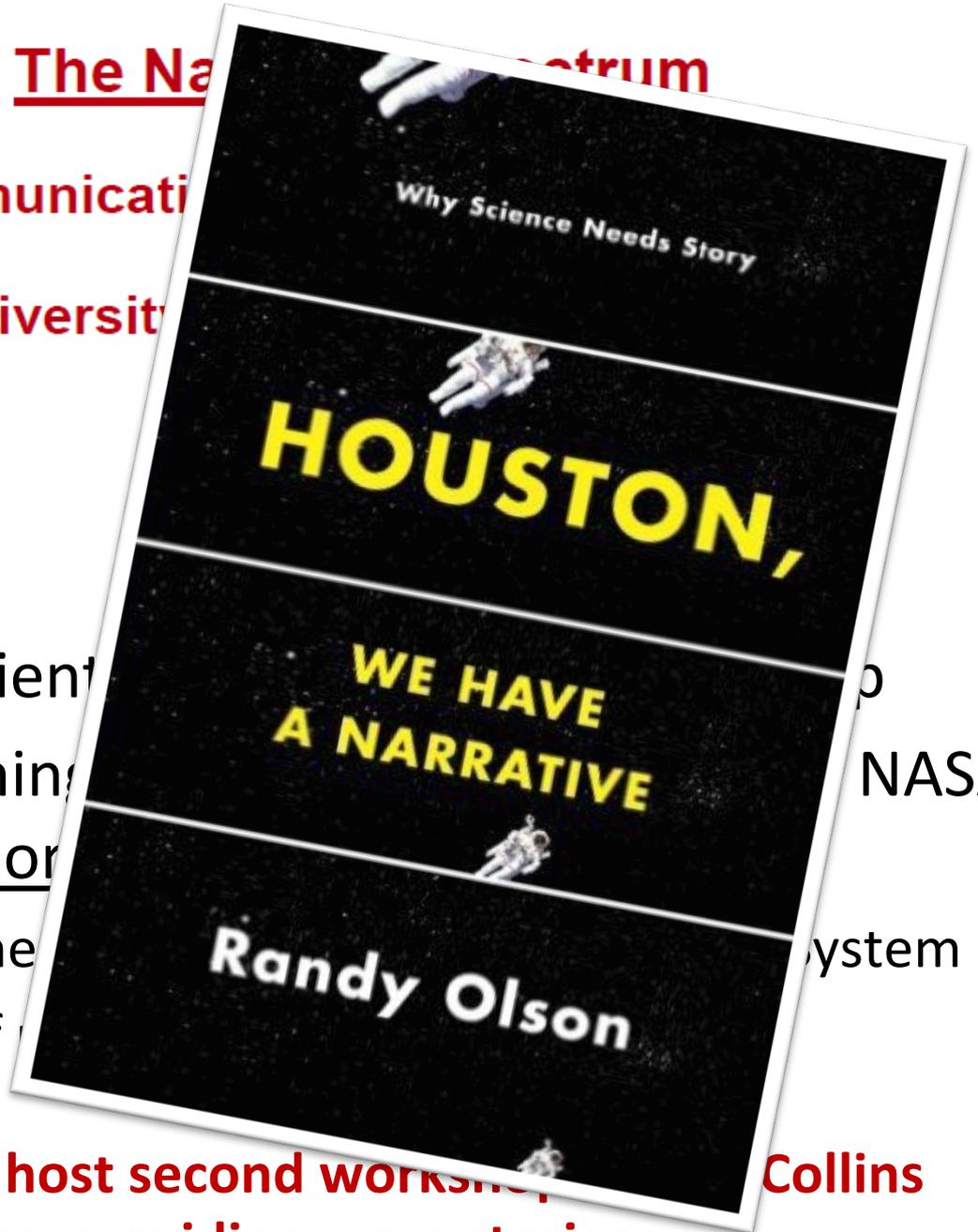




## The Narrative Spectrum

Communicati

Universit



- 25 managers and scientists
- USFWS is using training funded work into short
  - How extreme weather
  - External Affairs staff

NASA-

system

**This spurred USFWS to host second workshop with Collins  
with focus on providing more stories**



# The Narrative Spectrum

Communications Training for Scientists

University of Wisconsin- Madison

With

**Dr. Randy Olson**

- 25 managers and scientists attended the workshop
- USFWS is using training to translate results of our NASA-funded work into short stories
  - How extreme weather may affect N Wildlife Refuge System
  - External Affairs staff using stories in public outreach

**This spurred USFWS to host second workshop in Fort Collins  
with focus on providing more stories**





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## FWS RESPONSE

### Climate Change Update

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- July 2015
- May 2015
- March 2015
- January 2015
- October 2014
- September 2014
- July 2014
- May 2014
- March 2014

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...share success stories, identify key sources, .....

The U.S. Fish & Wildlife Service Climate Change Newsletter allows our staff to share success stories, identify key sources, and stay up-to-date about our agency's climate change response.

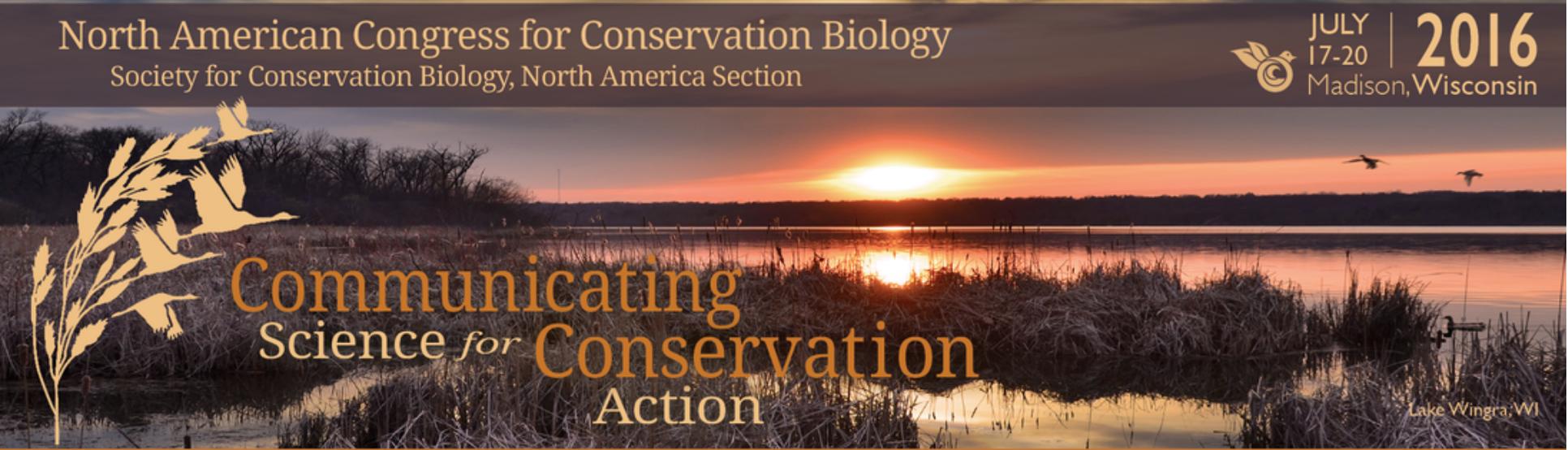
The National Wetland and scientists from across the Service are working together to develop this newsletter, and we welcome your input. Please contact [Kate Freund](#) to help provide content for future editions. You can explore past issues through the links at left.

**Stories to be used by Service biologists as they prepare to draft 10 year strategic plan for monitoring:**

- effects of management actions
- how climate projections are unfolding
- how habitats and wildlife are responding

#### Shared Stories and Profiles

#### Interagency Group Seeks Nominations for Climate Adaptation Leadership Award



Communicating  
Science *for* Conservation  
Action

Lake Wingra, WI

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**Thinking Like Mountains - A Practitioner's Symposium for Continental Conservation Under Climate Change**

Date: Monday, July 18, 2016

Time: 8:00 AM - 10:00 AM

Location: Exhibit Hall B

**Session Organizer 1:**

Anna M Pidgeon

**Affiliation 1:**

SILVIS Lab, Department of Forest and Wildlife Ecology, UW-Madison

**Session Organizer 2:**

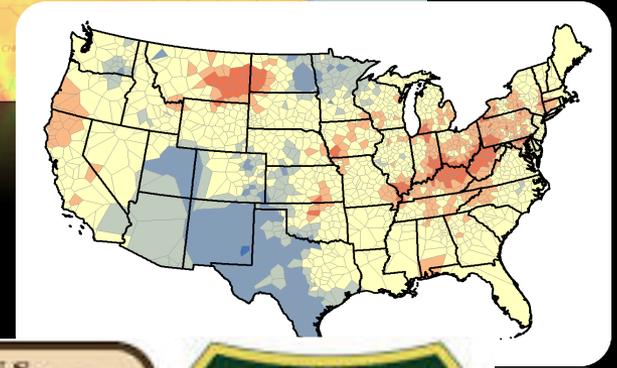
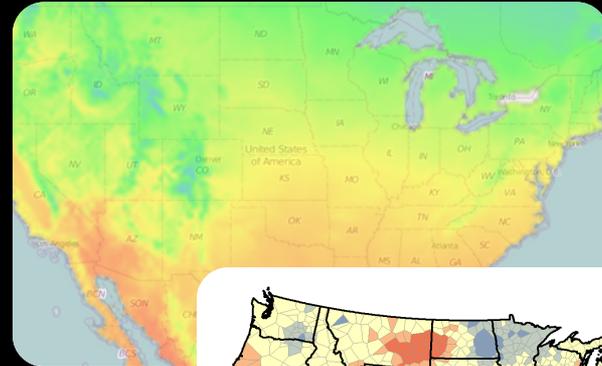
Patricia Heglund

**Affiliation 2:**

United States Fish and Wildlife Service, La Crosse, Wisconsin

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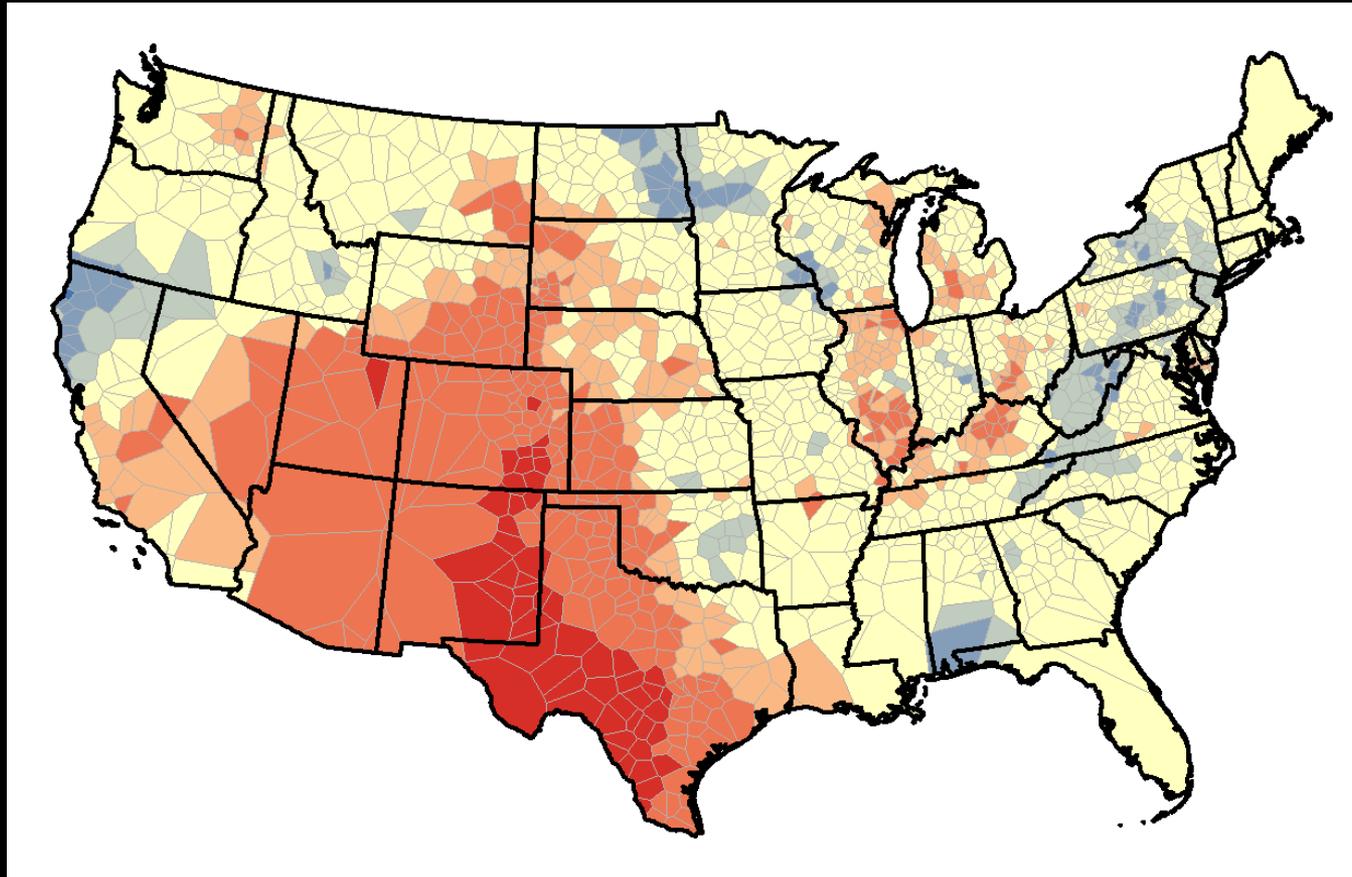




Thank you!

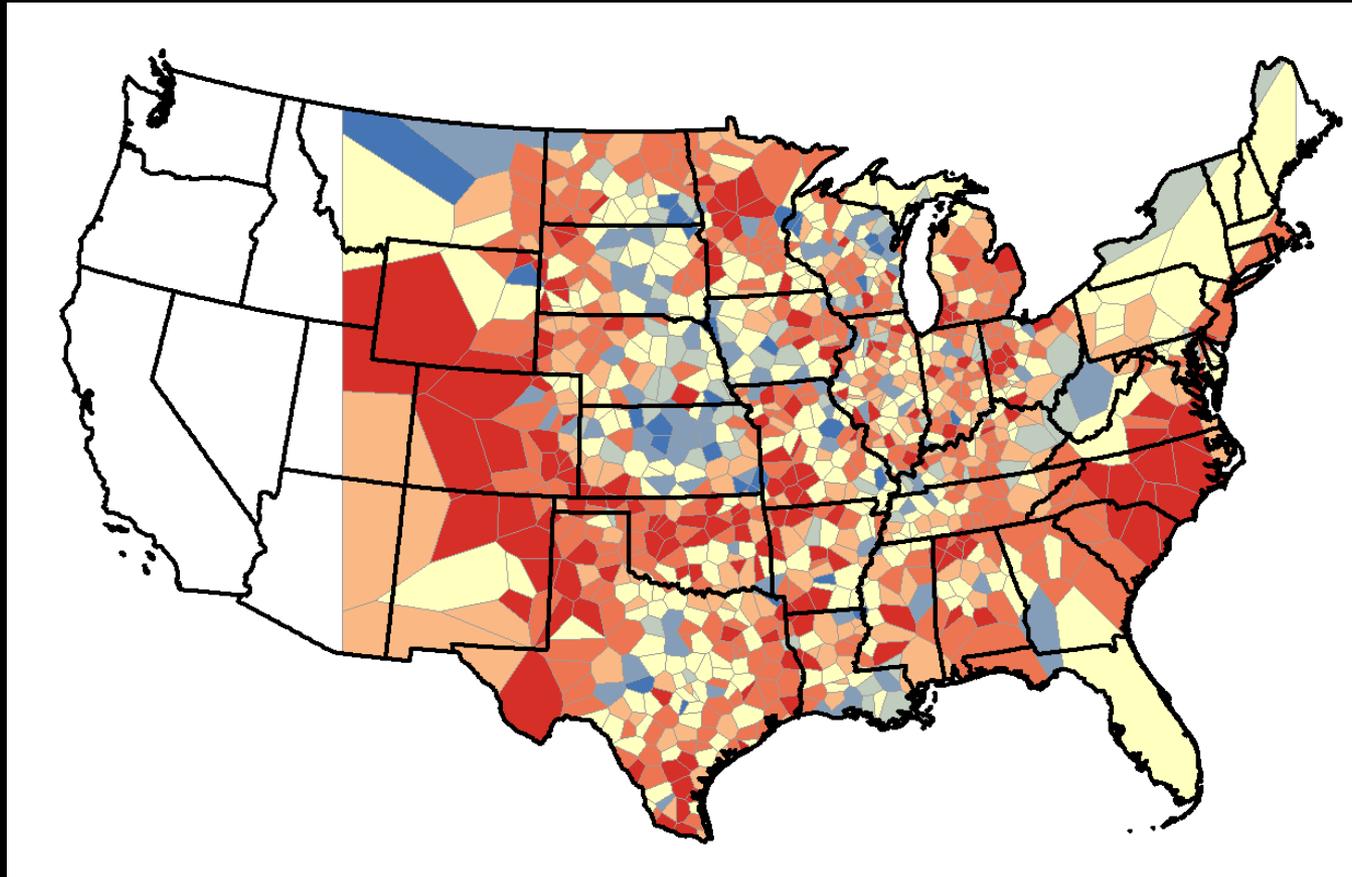


# Bird population responses



Grasshopper Sparrow L-SPEI

# Bird population responses



Dickcissel Local SPEI